# CSE 341 — Scheme Discussion Questions — Sample Solution

1. What do the following Scheme expressions evaluate to?

   (a) `(* 2 (+ 4 5))  =>  18`

   (b) `(= 3 (+ 1 3))  =>  #f`

   (c) `(car '(elmer fudd daffy duck))  =>  elmer`

   (d) `(cdr '(elmer fudd daffy duck))  =>  (fudd daffy duck)`

   (e) `(and (= 1 2) (= 10 (/ 1 0)))  =>  #f`

2. Find the squid! For each of the following variables, write an expression that picks out the symbol `squid`. For example, for this definition: `(define x '(squid clam octopus))` the answer is `(car x)`.

   (a) `(define y '(clam squid octopus))  =>  (cadr y)`

   (b) `(define z '(clam starfish (squid octopus) mollusc))  => (caaddr z)`

3. Define a Scheme function to find the average of two numbers.

```
(define (average x y)
  (/ (+ x y) 2))
```

4. Define a Scheme function `mymax` to find the maximum of two numbers.

```
(define (mymax x y)
  (if (> x y) x y))
```

5. Suppose we evaluate the following Scheme expressions:

```
(define x '(snail clam))
(define y '(octopus squid scallop))
```

   Draw box-and-arrow diagrams of the result of evaluating the following expressions. What parts of the list are created fresh, and which are shared with the variables `x` and `y`?

   (a) `(cons 'geoduck x))`

   (b) `(cons y y)`

   (c) `(append x y)`

   (d) `(cdr y)`

6. Define a recursive function `sum` to find the sum of the numbers in a list.

```
(define (sum s)
  (if (null? s)
      0
      (+ (car s) (sum (cdr s)))))
```

7. Define a tail recursive version of `sum`. (Define an auxiliary function if needed.)

```
(define (sum s)
  (sum-helper s 0))

(define (sum-helper s sofar)
  (if (null? s)
      sofar
      (sum-helper (cdr s) (+ (car s) sofar))))
```

8. Define a recursive function `myfilter` like the built-in `filter` function in Scheme.

```
(define (myfilter p s)
  (cond ((null? s) ())
        ((p (car s)) (cons (car s) (myfilter p (cdr s))))
        (else (myfilter p (cdr s)))))
```

9. What is the result of evaluating the following Scheme expressions?

(a)
```
(let ((x (+ 2 4))
      (y 100))
   (+ x y))
```

```
106
```

(b)
```
(let ((x 100)
      (y 5))
   (let ((x 1))
      (+ x y)))
```

```
6
```

10. Define a function `mylength` to find the length of a list.

```
(define (mylength s)
  (if (null? s)
      0
      (+ 1 (mylength (cdr s)))))
```